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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/059,588	01/28/2002	Michael R. Krames	M-11547 US	5828

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EXAMINER	
WILLE, DOUGLAS A	

ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 08/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/059,588	KRAMES ET AL.	
	Examiner	Art Unit	
	Douglas A Wille	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10,13-33,36-46 and 93-106* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10,13-33,36-46,93-106* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1 – 3, 6 – 10, 13 - 23, 25 - 28 and 32, 33, 36 – 46, 93, 94, 96, 97 and 99 – 106 are rejected under 35 U.S.C. 103(a) as being unpatentable over Joannopoulos et al. in view of Imada et al. and Vaudo et al.

3. With respect to claims 1 and 25, Joannopoulos et al. show a light emitting structure (see cover Figure and column 3, line 22 et seq.) where a periodic array of holes, which could be triangular (column 5, line 2), is provided and the material is GaAs (column 7, line 51) but do not show the spacing of the holes or an electrode structure. Imada et al. show a laser structure with a triangular lattice in InGaAsP and show a lattice constant of 0.462 microns with an active layer with a gap of 1.3 microns. Vaudo et al. shows a GaN based light emitting diode using (Ga, Al, In)N (see cover Figure and abstract). It would have been obvious to use the GaN material system instead of the GaAs shown by Joannopoulos et al. to provide a wider range of available wavelengths. It would have been obvious to use the lattice constant shown by Imada et al. in the Joannopoulos et al. device since it results in a working device. In the Imada et al. device the periodicity to wavelength ratio is in the range of 0.1 – 5 and both references show III-V materials. Note that Joannopoulos et al. show the holes as passing through the upper layer and the active layer and therefore the thickness of the second semiconductor layer is less than the

wavelength of emitted light. Joannopoulos et al. show that the structure will be biased in a conventional manner (column 7, 66).

4. With respect to claims 2 and 28, Joannopoulos et al. show a p-n junction (column 7, line 47).

5. With respect to claim 3, the substrate is doped GaAs and it would therefore be obvious to use an electrode on the bottom of the device since the complexity of forming a mesa can be avoided.

6. With respect to claims 6 and 27, the surface recombination velocity is inherent in the structure.

7. With respect to claim 7, the elements of Joannopoulos et al. and Imada et al. are both III-V.

8. With respect to claims 9 and 32, the periodic structure in periodic in the plane of the structure.

9. With respect to claims 10 and 33, the holes define the minima.

10. With respect to claims 13, 14, 36 and 37, Joannopoulos et al. show the array can be triangular, hexagonal, square or honeycomb (column 5, line 2).

11. With respect to claims 15 and 38, Joannopoulos et al. show that only the guided modes are polarized and the radiation modes show no polarization dependence.

12. With respect to claims 16 and 39, Joannopoulos et al. show the holes can be filled with a dielectric (column8, line 13).

13. With respect to claims 17 and 40, silicon oxide is a dielectric that has a low index and is commonly used with semiconductors and it would therefore be obvious to use it as a dielectric as a design alternative.

14. With respect to claims 18, 19, 41 and 42 emission at or near the band edge is inherent in the function of the device.

15. With respect to claims 20 and 43, Imada et al. show a fill factor of 0.2 (page 316, second column) and the dielectric constant runs between that for air and semiconductors.

16. With respect to claims 21 and 44, the extraction efficiency (column 4, line 5) is 70 % (column 5, line 59).

17. With respect to claim 8, Vaudo et al. shows a GaN based Light emitting diode using (Ga, Al, In)N (see cover Figure and abstract). It would have been obvious to use the GaN material system instead of the GaAs shown by Joannopoulos et al. to provide a wider range of available wavelengths.

18. With respect to claim 26, the material is III-V.

19. With respect to claims 22, 23, 45, 46 and 99,100,102,104 and 106, Joannopoulos et al. show that the gaps in the emission occur for various values of c/a and it would have been obvious to design the device to meet specific requirements as a matter of design optimization. Note that Vaudo et al. shows that the active layer is InGaN (column 13, line 41) and the electrode materials are the standard materials for this material system. Note that claim 99 shows the diameter without units but is assumed that the unit is "a".

20. With respect to claims 101, 103 and 105, Joannopoulos et al. show that the holes can be filled with air (column 8, line 14). Note that claim 103 shows the diameter without units but is assumed that the unit is "a".

21. With respect to claims 93, 94, 96 and 97. Joannopoulos et al. shows the holes as extending through the layers.

22. Claims 4, 5, 29, 30 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Joannopoulos et al. in view of Imada et al., Vaudo et al. and further in view of Kurahashi.

23. Joannopoulos et al. and Imada et al. do not show the electrode structure and Kurahashi shows an electrode structure with a DBR on a substrate to provide surface emission where resistance increase is prevented. It would have been obvious to use such a structure for the advantages shown for those cases where substrate contacts are not possible such as with sapphire.

24. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Joannopolous et al. in view of Imada et al. and further in view of Roberts et al.

25. The basic device is an emitter structure without a housing, which would be necessary to make a finished device. Roberts et al. show a finished package that includes (see cover Figure and column 9, line 3 et seq.) a lead frame 205, heat sink 204 and transparent encapsulant 203.

26. Claims 95 and 98 are rejected under 35 U.S.C. 103(a) as being unpatentable over Joannopoulos et al. in view of Imada et al., Vaudo et al. and further in view of Dodabalapur et al.

27. Dodabalapur et al. show the use of a one-dimensional photonic crystal as a distributed feedback laser with the grating in the active layer (column 5, line 32). It would have been obvious to form this structure since it is a known variation of a laser structure.

Response to Arguments

28. Applicant's arguments filed 4/4/03 have been fully considered but they are not persuasive.

29. Applicant states that Joannopoulos et al. do not show an electrode but note that Joannopoulos et al. show that the structure will be biased in a conventional manner (column 7, 66). While specifics are not shown it must be assumed that Joannopoulos et al. know how to do it and a number of alternatives could be suggested by Examiner.

30. Applicant states that there is no teaching of how to modify the electrode of Imada et al. for use on a device with holes but Joannopolous et al. show that it is conventional.

31. Applicant states that the Imada et al. electrode is not suitable for an LED but see above where the teaching of Joannopolous et al. is relied upon.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas A Wille whose telephone number is (571) 272-1721. The examiner can normally be reached on M-F (6:15-2:45).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Douglas A. Wille
Primary Examiner

August 17, 2004